

## | CLAIMS |

What is claimed is:

1. A device for generating single photons one at a time at room temperature, comprising:
  2. (a) a single molecule; and
  3. (b) a light source for delivering a light pulse to said single molecule to excite said single molecule to an excited state after which said single molecule emits said single photon.
1. 2. The device as set forth in claim 1, further comprises a means for directing said light pulse to said single molecule.
1. 3. The device as set forth in claim 1, wherein said excited state comprises a vibrational manifold.  
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1. 2. 4. The device as set forth in claim 1, further comprises a means for collecting said single photon.
1. 2. 5. The device as set forth in claim 1, wherein said single molecule has a high quantum yield for photon emission.

1       6. The device as set forth in claim 1, wherein said single molecule has a fluorescence  
2       ~~6~~<sup>6</sup> lifetime on the order of ns.

1       7. The device as set forth in claim 1, wherein said single molecule is a terrylene  
2       molecule, a derivative of said terrylene molecule, a dibenzoanthanthrene molecule,  
3       a derivative of said dibenzoanthanthrene molecule, a pentacene molecule, a  
4       derivative of said pentacene molecule, a perylene molecule or a derivative of said  
5       pentacene molecule.

1       8. The device as set forth in claim 1, wherein said single molecule is a planar  
2       aromatic hydrocarbon with an electric dipole allowed lowest electronic excited  
3       state.

1       9. The device as set forth in claim 1, wherein said single molecule is a planar  
2       aromatic molecule.

1       10. The device as set forth in claim 1, wherein said single molecule is a laser dye.

1       11. The device as set forth in claim 1, wherein said single molecule is in a solid host.

1       12. The device as set forth in claim 11, wherein said solid host is p-terphenyl.

13. The device as set forth in claim 11, wherein said solid host is a molecular crystal.

14. The device as set forth in claim 11, wherein said solid host is an amorphous organic solid.

15. The device as set forth in claim 1, wherein said light source is a pulsed pumping laser.

¶ 6. A method for generating single photons one at a time at room temperature, comprising the steps of:

- a. providing a single molecule; and
- b. delivering a light pulse with a light source to said single molecule to excite said single molecule to an excited state after which said single molecule emits said single photon.

17. The method as set forth in claim 16, further comprises the step of providing a means for directing said light pulse to said single molecule.

18. The method as set forth in claim 16, wherein said excited state comprises a vibrational manifold.

1       19. The method as set forth in claim 16, further comprises the step of providing a  
2                   means for collecting said single photon.

1       20. The method as set forth in claim 16, wherein said single molecule has a high  
2                   quantum yield for photon emission.

1       21. The method as set forth in claim 16, wherein said single molecule has a  
2                   fluorescence lifetime on the order of ns.

1       22. The method as set forth in claim 16, wherein said single molecule is a terrylene  
2                   molecule, a derivative of said terrylene molecule, a dibenzoanthanthrene molecule,  
3                   a derivative of said dibenzoanthanthrene molecule, a pentacene molecule or a  
4                   derivative of said pentacene molecule, a perylene molecule or a derivative of said  
5                   perylene molecule.

1       23. The method as set forth in claim 16, wherein said single molecule is a planar  
2                   aromatic hydrocarbon with an electric dipole allowed lowest electronic excited  
3                   state.

1       24. The method as set forth in claim 16, wherein said single molecule is a planar  
2                   aromatic molecule.

25. The method as set forth in claim 16, wherein said single molecule is a laser dye.

26. The method as set forth in claim 16, wherein said single molecule is provided in a solid host.

27. The method as set forth in claim 26, wherein said solid host is p-terphenyl.

28. The method as set forth in claim 26, wherein said solid host is a molecular crystal.

29. The method as set forth in claim 26, wherein said solid host is an amorphous organic solid.

30. The method as set forth in claim 16, wherein said light source is a pulsed pumping laser.

31. A controllable source of single photons generated one at a time using optical pumping of a single molecule in a solid at room temperature.  $\text{H}_2 \Rightarrow$  no structure

1      32. A single photon obtained by optical pumping of a single molecule in a solid at room  
2      temperature. ( $\Rightarrow$  no structure.)

1 33. A source of single photons obtained one at a time at room temperature by pulsed optical  
2 excitation of a single highly fluorescent molecule. 112  $\Rightarrow$  no structure.

1 34. A single photon obtained by a pulsed optical excitation of a single highly fluorescent  
2 molecule at room temperature. 112  $\Rightarrow$  no structure.

1 35. A system for collecting single photons one at a time at room temperature, comprising:  
2 a. a single molecule;  
3 b. a light source for delivering a light pulse to said single molecule to excite said  
4 single molecule to an excited state after which said single molecule emits said  
5 single photon; and  
6 c. a means for collecting said single photon.

1 36. The system as set forth in claim 35, further comprises a means for directing said  
2 light pulse to said single molecule.

1 37. The system as set forth in claim 35, wherein said excited state comprises a  
2 vibrational manifold.

1 38. The system as set forth in claim 35, wherein said single molecule has a high  
2 quantum yield for photon emission.

1       39. The system as set forth in claim 35, wherein said single molecule has a  
2                   fluorescence lifetime on the order of ns.

1       40. The system as set forth in claim 35, wherein said single molecule is a terrylene  
2                   molecule, a derivative of said terrylene molecule, a dibenzoanthanthrene molecule,  
3                   a derivative of said dibenzoanthanthrene molecule, a pentacene molecule or a  
4                   derivative of said pentacene molecule, a perylene molecule or a derivative of said  
5                   perylene molecule.

1       41. The system as set forth in claim 35, wherein said single molecule is a planar  
2                   aromatic hydrocarbon with an electric dipole allowed lowest electronic excited  
3                   state.

1       42. The system as set forth in claim 35, wherein said single molecule is a planar  
2                   aromatic molecule.

1       43. The system as set forth in claim 35, wherein said single molecule is a laser dye.

1           44. The system as set forth in claim 35, said single molecule is in a solid host.

1           45. The system as set forth in claim 45, wherein said solid host is p-terphenyl.

1           46. The device as set forth in claim 45, wherein said solid host is a molecular  
2           crystal.

1           47. The device as set forth in claim 45, wherein said solid host is an amorphous  
2           organic solid.

1           48. The system as set forth in claim 35, wherein said light source is a pulsed pumping  
2           laser.

1           49. The system as set forth in claim 35, wherein said means for collecting comprises  
2           an optical cavity resonator.

1           50. The system as set forth in claim 35, wherein said means for collecting comprises  
2           an optical fiber.